REMARKS

Claim 2 is amended herein to recite that the viscosity modifier is a polymer. Support for the amendment is found for example at page 7, lines 22-24 and Tables 1-6 of the specification. No new matter is presented.

Entry of the proposed claim amendment is deemed proper after final rejection and is respectfully requested since the amendment merely clarifies the invention.

Upon entry of the amendment, claims 2-7 will be all of the claims pending in the application.

I. Response to Rejection under 35 U.S.C. § 103

Claims 2-7 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent Application Publication 2002/0022695 to Ueno et al in view of CN 1123302 A to Ding et al.

Ueno et al was cited as disclosing a polymerizable unsaturated polyester resin composition meeting the terms of the rejected claims, except for the claimed viscosity modifier *consisting essentially of* the units (a), (b) and (c).

Ding et al was cited as disclosing a viscosity modifier for acrylic and other resins, consisting essentially of (a) 10-30% alkyl(meth)acrylate containing an epoxy group; (b) 40-70% of another alkyl(meth)acrylate; and (c) 10-40% by weight of another vinyl monomer copolymerizable therewith. Ding et al was also cited as disclosing a weight average molecular weight of 1,000-10,000 within the claimed range.

Applicants respectfully traverse the rejection.

Ueno et al does not teach a composition comprising a thermoplastic polyester resin and a viscosity modifier. Rather, Ueno et al discloses a polymerizable unsaturated polyester resin composition which includes various monomers said to overlap in scope with present claim 2. Ueno et al does not mention the term "viscosity modifier" and it is unclear as to how the Examiner arrived at the conclusion that Ueno et al teaches a viscosity modifier in the first instance.

To further distinguish the invention from Ueno et al, claim 2 is amended to recite that the viscosity modifier is a polymer consisting essentially of the units (a), (b) and (c). Thus, the viscosity modifier of the present invention, added to the thermoplastic polyester resin as a polymer, is further distinguished from the polymerizable resin composition of Ueno et al comprising a collection of monomers as set forth, for example, in Synthesis Example 1 at paragraphs [0054]-[0055].

Additionally, contrary to the Examiner's assertion, Ding et al does not teach, suggest or even mention a thermoplastic resin composition comprising a thermoplastic polyester resin and a viscosity modifier. An English translation of Ding et al obtained from Examiner Bernshteyn is attached for the record. Ding et al is silent as to a viscosity modifier and therefore can not be said to teach a viscosity modifier consisting essentially of units (a), (b) and (c) as recited in present claim 2. Thus, the argument could be made that even if the references were combinable, the resulting combination would not achieve the present invention.

Furthermore, it does not appear that one of ordinary skill in the art would have had an apparent reason to combine the Ueno et al and Ding et al in the first instance. This is because Ding et al relates to a resin for the preparation of an acreolic powder coating, which is a

decorative outdoor coating, whereas Ueno et al relates to a method of chemically recycling waste polyethylene terepthalate (PET) such as PET bottles (see paragraph [0002] of Ueno et al). Thus, Applicants submit that one of ordinary skill in the art would not have been motivated to combine the references with a reasonable expectation of success in achieving the claimed invention. Thus, the present invention is not rendered obvious based on the combination of Ueno et al and Ding et al.

Accordingly, Applicants respectfully request withdrawal of the rejection.

II. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Jennifer M. Hayes / by agR Reg. No. 33,276

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Jennifer M. Hayes
Registration No. 40,641

Date: May 22, 2007

10/530,515

From Carol LeFord

PTO 07-3392

Chinese Patent

1123302

NEW ACROLEIC POWDER COATING AND ITS PREPARATION

[Xinxing Bingxisuan Fenmo Tuliao Ji Zhibei Fangfa]

DING Wenguang, SHI Ning, ZHAO Yuting

LIU Fusheng, SUN Zhongxin

UNITED STATES PATENT AND TRADEMARK OFFICE

Washington, D. C. March 2007

Translated by: Schreiber Translations, Inc.

Country	:	People's Republic of China
Document No.	:	94114195.0
Document Type	:	Patent
Language	:	Chinese
Inventor	:	DING Wenguang, SHI Ning, ZHAO Yuting, LIU Fusheng, SUN Zhongxin
Applicant	:	Petro China Qilu Petroleum & Chemical Corporation
IPC	:	C09D 133/02
Application Date	:	November 25, 1994
Publication Date	:	May 29, 1996
Foreign Language Title	:	Xinxing Bingxisuan Fenmo Tuliao Ji Zhibei Fangfa
English Title	:	New Acroleic Powder Coating and Its Preparation

/0[1]

[57] Abstract

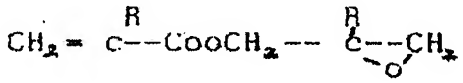
This invention relates to an acroleic power coating, the raw material resin, and the coating preparation method. The invention adopts solution polymerization method. Three conventional monomers are polymerized into acroleic resin containing epoxy group. Various fillers and adjuvant are added to the resin and undergone thermal melting, blending, and crushing processes to finally obtain acroleic powder coating for industrial applications. The product and preparation method feature low cost, easy access of raw materials, simple preparation process, and stable performance.

[1] Numbers in the margin indicate pagination in the foreign text.

Claims

What is claimed is:

1. A resin for the preparation acroleic powder coating, including metalcrylic acid ester or acrylic ester (A) containing epoxy group



with the general formula of (R is H or CH_3), acrylic alkyl ester (B) with the general formula of

(R_1 is H or CH_3, R_2 is C1-18 alkyl), and aromatic compound (C) containing acetyl, wherein the resin is comprised of the above three monomers and that the contents are (in weight percentage):

a. 10~30% of A,

b. 40~70% of B,

c. 10~40% of C.

wherein the molecular weight of the resin is 1000~10000 and the softening point is 80~120°C.

2. The resin in Claim 1, wherein the said metalcrylic acid ester or acrylic ester containing epoxy group can be metalcrylic acid

glycidic ester or acrylic glycidic ester.

3. The resin in Claim 1, wherein the said acrylic alkyl ester can be (methyl) methyl acrylate, (methyl) ethyl acrylate, (methyl) acrylic acrylate, (methyl) butyl acrylate, and (methyl) acroleic acid 2--ethyl phthalate.

4. The resin in Claim 1, wherein the said aromatic compound containing acetyl can be styrene, methyl styrene, and ethyl styrene.

5. The resin in Claim 1, wherein the optimum molecular weight of the resin is 3000~5500 and the optimum softening point is 100~110°C.

6. A powder coating made of the resin in Claim 1 consisting of acroleic resin, filler, curing agent, leveling agent, and catalyst, wherein the compositions and contents of the coating are (in weight percentage):

30~90% of acroleic resin;

15~30% of filler;

/2

5~20% curing agent;

0.5~0.7% leveling agent; and

0.1~3.0% catalyst.

7. A method for the preparation of acroleic acid powder coating, including preparing resin, blending fillers, pigment, curing agent,

leveling agent, and catalyst with the resin in proper proportions, extruding and shearing, mixing, crushing, and sieving processes, wherein the resin in the invention is applied in the preparation method.

8. The method in Claim 7, wherein the degassing method is employed in the process of resin preparation, wherein the degassing temperature is 180~210°C and the vacuum is controlled at 1.0~1.0X10 Pa.

/1

Instructions

New Acroleic Powder Coating and Its Preparation

The invention relates to a new resin compound for the preparation of acroleic powder coating and a method for the preparation of the powder coating.

Acroleic powder coating is a decorative, outdoor coating with superior adhesive force. It is independent of solvent and thus completely overcomes the toxicity, fire, and pollution to environment brought about by solvent. For this reason, it is becoming more and more popular in appliance, bicycle, and motor industries. The applicability of the coating is superior to epoxy powder coating and

even polyester powder coating.

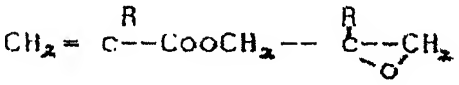
The development of acroleic acid powder coating is very active in Japan. Japanese patents S50-158621 and S50-159518 revealed acroleic powder coating, where the film forming agent used contains epoxy (methyl) acrylic ester, (methyl) acrylic alkyl ester, and other aggregate monomers. In addition, other modified resins containing glycerin ester are adulterated to increase crosslinking density. The above method can make good performance powder coating. However, the modifying resin is very costly and difficult to acquire in China. As such, the powder coating is expensive and economically unreasonable.

The objective of the invention is to provide a low cost acroleic acid powder coating with easy access of raw material, simple preparation process, and stable performance, as well as provide a resin for coating preparation.

The objective of the invention is realized by using the resin of the invention to prepare new acroleic powder coating. The resin used in the invention is (methyl) acrylic ester polymer consisting of three types of monomers. It is not necessary to add other modifiers to increase crosslinking density. The three types of monomers are:

a. 10~30% (weight) metalcrylic acid ester or acrylic ester

containing epoxy group with the general formula of



, where R is H or CH_3, such as metalcrylic acid glycidic ester or acrylic glycidic ester.

b. 40~70% (weight) acrylic alkyl ester with the general formula

of , where R_1 is H or CH_3 and R_2 is C1-18 alkyl such as (methyl) methyl acrylate, (methyl) ethyl acrylate, (methyl) acrylic acrylate, (methyl) butyl acrylate, and (methyl) acroleic acid 2--ethyl phthalate.

/2

c. 10~40% (weight) aromatic compound containing acetyl, such as styrene, methyl styrene, and ethyl styrene.

The technical solution of the invention is described as follows:

Preparation of polymer resin: Undertake polymerization reaction to the above three monomers to make polymer. The polymerization method includes solution polymerization, emulsion polymerization, suspenoid polymerization, and bulk polymerization, among which the solution polymerization is the most appropriate method. The solution used includes methylbenzene, ethylbenzene, dimethyl benzene, benzene, acetone, and methyl ethyl ketone, among which methylbenzene is most

appropriate. The polymerization temperature is generally controlled at 105~115°C. The initiating agent used in the polymerization process includes peroxide compound and azo compound such as benzoyl peroxide, N'-hydrogen peroxide, diisopropylbenzene peroxide, and azodiiso cyanogen. The usage is 1~5% (weight) of monomer weight.

Undertake degassing treatment to the above polymers to remove solvent and obtain resin for powder coating. The degassing method includes continuous tower degassing method and intermittent kettle degassing method. The tower degassing method offers continuous operation and high output. However, the product quality is hard to control and the requirement for equipment is strict. The kettle degassing method is characterized by high equipment investment but ease of control over product quality and easy operation. The degassing temperature is generally controlled at 180~210°C and the vacuum is controlled at $1.0\sim1.01X10^5$ Pa. At the end of degassing treatment, release the resin and cool down to room temperature to obtain light yellow brisk resin.

The resin prepared in the invention has the following characteristics: Molecular weight: 1000~10000 (3000~5500 is optimal); Softening point: 80~150°C (100~110°C is optimal); Glass state temperature: 45~70°C (50~65°C is optimal); Molecular weight

distribution: below 2.0. The content of volatile substance is 1~10% (weight) (the optimum is ≤8%), otherwise the storability and film complexion of the powder coating will be affected. The above tests are done in accordance with international standard.

/3

The resin prepared according to above method are blended with fillers, pigment, curing agent, leveling agent, and catalyst in certain proportion, and is shearing mixed with screw extruder, crushed, and sieved to obtain the powder coating of the invention.

In the powder coating of the invention, the resin content is 30~90% (weight). The filler used in the powder coating includes titanium pigment, light calcium carbonate, lithopone, and hydrated magnesium. The usage is 15--30% (weight).

The pigment used in the powder pigment is identical to that used in solvent lacquer. The usage is determined according to the needed chrominance.

The curing agent used in the powder coating is aliphatic binary carboxylic acid, such as adipic acid, decanedioic acid, lauric acid, and tetradecyl diacid. The usage is 5~20% (weight).

The leveling agent used in the powder coating is acrylic highcarbonol ester polymer available in the market, such as GLP series

leveling agent produced by Ningbo Nanhai Chemicals Co. Ltd. The usuage is 0.5~0.7% (weight).

The catalyst used in the powder coating is quanternary ammonium compound, such as cetyl tributyl ammonia chloride, benzyl trimethyl ammonium bromide, tetrabutyl ammonium iodide, and cetyl trimethyl ammonium bromide. The usage is 0.1~0.3% (weight).

The coating of the invention is 180--200-mesh granularity, free-flow powder. It can be sprayed on phosphorized metal surface and baked to obtain smooth film, straight, consistent color surface coating. The common coating methods include friction coating, electrostatic coating, flow bed coating, among which the electrostatic coating method is more suitable.

With the powder coating of the invention, the coating layer offers 90~94 (160°C) mirror glossiness (measured according to GB1743-79), 2.94~4.41 Joel impact strength (measured according to GB1732-79), Grade 1~2 flexibility (measured according to GB1731-79), Grade 1~2 adhesive force (measured according to GB1720-79), and over 2H pencil hardness.

/4

The acroleic powder coating and the resin preparation method of the invention are further explained through the following

implementations:

Implementation 1

The formula of resin monomer is:

Acrylic butyrin	25g
Methyl acrylic methylester	35g
Metacrylic acid glycidyl ester	18g
Styrene	22g

Homogenously blend the above monomer with 1.8g benzoperoxide.

Add 100g methylbenzene in a 250ml four-opening, round bottom flask with reflux condenser. Conduct in N_2 to replace the air in the flask. Start agitation and heat to 109~112°C when methylbenzene begins to reflux. Keep the temperature unchanged and start to nitrate blended monomer in 2h. Add 0.2g benzoperoxide and keep reaction at the same temperature for 2h to obtain uniform, transparent, sticky polymer solution.

Add 200g above polymer solution to a 250ml three-opening flask. Start agitation and heat for degassing treatment until methylbenzene is boiled and distilled. With the evaporation of methylbenzene, the temperature rises gradually. When the temperature reaches 140°C, start to vacuum and elute methylbenzene until the temperature reaches 220°C and the vacuum is 1.0×10^5 Pa. Pour out the resin at heat and

cool down to room temperature to obtain light yellow, transparent, brisk resin.

Implementations 2~5

The monomer formulas for resin synthesis are shown in Table 1. The other steps are identical to those in Implementation 1.

/5

Table 1

Implementation	2	3	4	5	6	7
Metacrylic acid glycidyl ester (g)	20	18	20	19	20	28
Metacrylic methyl ester (g)	35		33		15	
Styrene (g)	17			18	15	35
Methyl styrene (g)		22	22		20	
Metacrylic acid butyrin (g)	28		25	28	25	
Methyl metacrylic acid butyrin (g)		25				12
Metacrylic acid methyl ester (g)		35		35	30	
Molecular weight (g)	5600	2590	8200	3540	5800	9300
Softening point (°C)	108	91	119	101	110	120

Implementation 8

The formula of resin monomer is:

Resin in Implementation 1 70g

Titanium pigment (Anatase titanium dioxide) 25g

Decanedioc Acid 10g

GLP505 leveling agent 0.7g

Cetyl tributyl ammonia chloride 0.5g

Ultramarine 1g

Blend the above substances in a high speed agitator for 5 minutes, and then undertake extrusion on a single screw extruder. The extrusion temperature is 110°C. Cool down the extruded substance, crush, and sieve with 180-mesh sieve to obtain powder, free-flow particles, which are acroleic powder coating.

/6

Spray the coating on phosphorated sample through electrostatic spray method under the voltage of 50KV and the air pressure of 1.5 atmospheric pressure. The coated sample is cured at 180°C for 20 minutes. The properties of the sample are tested according to state standard method. The test results are listed along with related comparison data in Table 2.

Table 2

Item	Actual Measurement	Measurement in S50-158621 Patent
Impact Strength (Joel)	3.01	
Glossiness (60°C)	94	92

Adhesive Force	Grade I	
Flexibility	Grade I	
Hardness	2H	

Implementation 9~14

The coating formula is shown in Table 3. The other steps are identical to those in Implementation 8.

Table 3

Implementation	9	10	11	12	13	14
Resins in Implementations 2~7 (g)	70	60	80	70	30	95
Titanium pigment (g)	15	25	20	15	40	30
Light calcium carbonate (g)	10					
Lithopone (g)			10	10	10	
Ultramarine (g)	1	1	1	1	1	1
Decanedioic acid (g)		8	12	10		20
Adipic acid (g)	8				8	
GLP leveling agent (from market) (g)	0.7	0.5	0.7	1.0	2.0	0.3
Cetyl trimethyl ammonium bromide (g)	0.5		0.5		1	
Tetrabutyl ammonium bromide (g)		0.8		0.5		2.0
Impact strength (Joel)	3.0	2.96	3.6	3.0	3.4	3.2
Glossiness (%)	90	91	90	93	91	91